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PAPERS

IN

MECHANICKS.

MECHANICKS.

The SILVER MEDAL of the SOCIETY, or TWENTY GUINEAS, at his option, was this Session voted to Dr. JOHN WINTERBOTTOM, of Newbury, in Berkshire, for a MACHINE for Clearing Turnpike and other Roads from Mud.

Dr. Winterbottom preferred the Honorary Reward of the Society.

The following Account was received from him, and an Engraving of the Machine, with a description thereof, hereunto annexed.

A Model of this invention is placed in the Society's Repository.

SIR,

I REQUEST that you will lay before the Society of Arts the Model and Paper which accompany this Letter; they are sent in conformity to the advertisement, No. 147, of last year.

I am, SIR,

Your most obedient Servant,

JOHN WINTERBOTTOM.

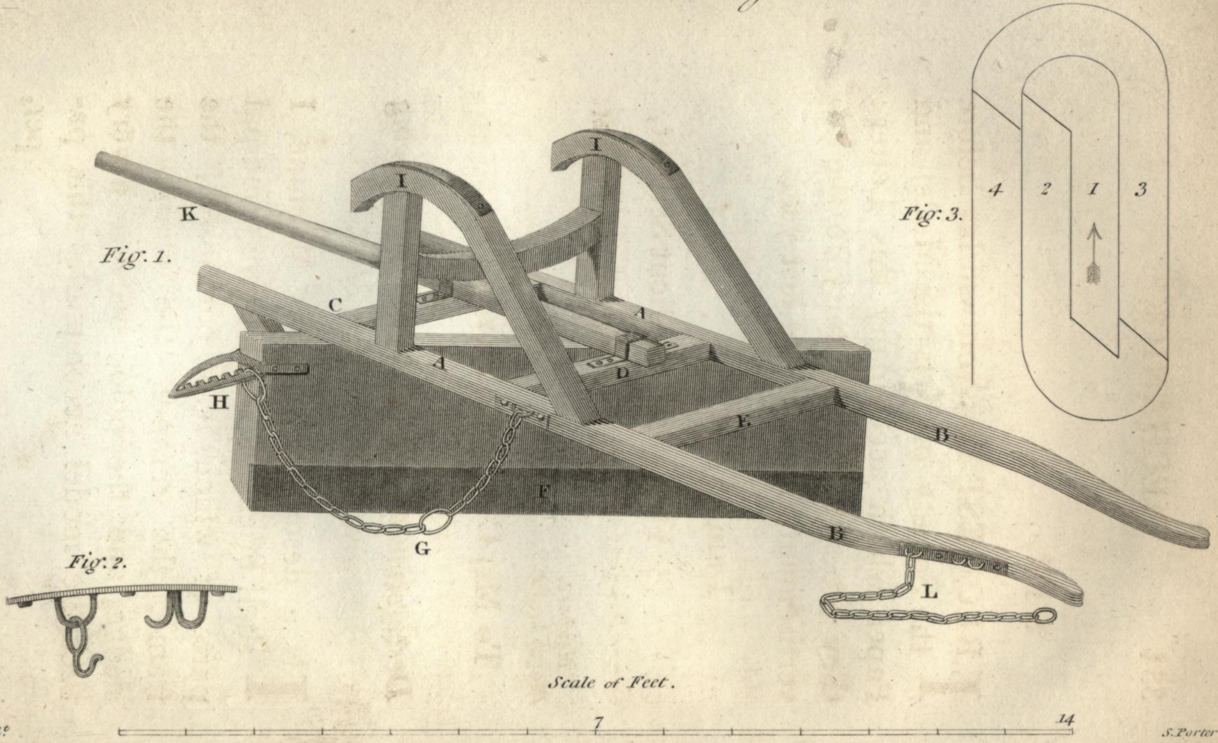
Newbury,
March 1, 1803.

To Mr. CHARLES TAYLOR.

Description of a MACHINE *for Clearing great Roads from Mud.*

IN a description of this Machine, I shall briefly notice the five principal parts of which it is composed; the frame, the scraper, the chain, the sledge, and the pole; because a very accurate model accompanies this paper, Pl. VI.

D^r. Winterbottoms Machine for clearing Roads from Mud.



Clint del^t.

S. Porter sculp.

per, made upon the usual scale of one inch to a foot.

The *frame* (see *Plate VI. Fig.* 1.) consists of two pieces of timber AA, which at one extremity are formed into a pair of shafts B B, and at the other are strongly united by three transverse pieces C D E.

The *scraper* F is placed under this frame-work, in an oblique direction, at an angle of 30 degrees, between two of the transverse pieces C D, and consequently forms an angle of 150 degrees with the line of draught. By this position of the scraper, the machine, when used, actually clears itself from the mud as fast as it is collected, and removes it into a heap on one side, after the manner of a plough.

The *chain* G is connected with a piece of iron-work H, which projects from the lower end of the scraper; for here additional power is required; as the whole body of the mud, which has been collected, must pass off by this extremity. Some advantage has also been gained by making this end of the scraper shorter than the other.

The *sledge* I I is constructed upon the upper part of the frame, that by inverting the machine it can be transported without injury to the scraper, over the most rough and stony roads, or pavements, to those places where its use is particularly required.

The *pole* K, which is moveable, serves the purpose of a rudder, that when the machine happens to be forced by any great weight of mud, or solid body of earth, &c. from its proper direction, it can be easily restored to its former position: and it may also be observed, that the moderate pressure of the hand upon the pole tends to make the machine steady, and therefore causes it to work to more advantage. In the model, the pole is made only ten inches long, instead of fifteen, that it might occupy less space in the box. The plates in front of the scraper, and upon the sledge, are made of cast-iron.

Operation.

For the operation of the machine, two men and four horses are required; one man to drive the horses, and another to take the management of the pole and the direction of the labour to be performed. The horses are to be worked double, as commonly practised, two being employed to draw by the shafts, and two by the chain above described. But the manner of using the machine will be best understood by the following sketch. *Plate VI. Fig.* 3.

The first progress of the machine marked No. 1, commencing from the Arrow mark, will remove the mud in a line to the right; the first return, No. 2, will remove another part of it to the left. The second progress, No. 3, will take up what was left by No. 1, besides the quantity which is upon the space now to be passed over, and will remove it all to the right. The second return, No. 4, will operate in a similar manner with regard to No. 2, and remove that to the left. Thus, by four lengths, more than twenty feet wide of a road can be cleared; and this has been frequently performed in the presence of several persons. The number of lengths may be increased at pleasure, according to the width of the road.

In the neighbourhood of London, where there is incessant travelling, it would be advisable to use two machines at the same time, one immediately following the other, as in No. 1 and 3, which will leave a space sufficiently wide for the largest carriage to pass, without disturbing the mud already scraped up.

There is one advantage in the operation of this machine worthy of being noticed, which is, that by the use of it the road is made more even and smooth, the small holes being filled up by the more solid parts of the mud; whereas, when roads are scraped in the usual way, by hand, all the irregularities are increased, and become the future deposits of water; and it is universally known that these puddles, as they are called, are the chief cause of the destruction of roads.

It has been observed, that stones are sometimes forced up by the machine; but it appears to be those only which project in such a degree as to be dangerous to the traveller, and which require to be broken for the more effectual mending of the road.

I can say nothing concerning the effect of the machine upon dusty roads, having had no opportunity of trying it at that season of the year. When, indeed, the roads are watered, as about London, there is no doubt but a great quantity of that dirt may be removed, which, in a few hours of scorching sun, would again be converted into a body of dust.

If it should be objected, that the machine is too large, and that a smaller one, which might pass over half the space of ground that this does, and might be worked by two horses, would be better; I must beg leave to answer, that, in my opinion, with a less one there would be much labour to little purpose; because this machine, which passes over a space of about six feet and a half, will not, in some places, when the roads are very wet and very deep, leave more than three feet clear, the mud on each side falling in and filling up, to a considerable extent, the space already passed over: it must therefore be obvious, that, under similar circumstances, the track of a smaller one would almost instantly be obliterated.

TESTIMONIALS.

I am so anxious that the Society should have ample satisfaction on this head, that I should be happy if they would, before finally determining on the utility of this machine, condescend to make some inquiries in this part of the country, where it has been publicly tried.

I can however mention, with some pleasure, that several gentlemen, acting as Commissioners of the Roads, have honoured me with their attendance during various experiments; and, having witnessed the very powerful effects of the machine, they have given it their public approbation at the last monthly meeting, when the following entry was made in their minute-book:—

" At a meeting of Trustees of the London and Bath roads, held at the Globe Inn, Newbury, on Monday, the 21st of February, 1803. At this meeting were present, James Croft, Esq. Frederick Cowslad, Esq. Rev. Thomas Best, Mr. Richard Baily, Mr. Thomas Clark, Mr. John Baily, Mr. Joseph Tanner, Mr. Thomas Pocock.

" Resolved, that the machine invented by Dr. Winterbottom, for scraping off mud from turnpike roads, will be of public utility, and save considerable expense of labour."

After this public testimony in its favour, I might perhaps be excused from producing the certificates of a few individuals : it will, notwithstanding, be necessary to give some estimate of the probable saving to be expected from its use.

In all trials made previous to the 21st of February, the machine had been worked upon no measured extent of ground; but the general effects were such, that several persons of great experience in the management of roads, rated the daily work of one machine only as equal to the labour of fifty or seventy men; fifty being the lowest estimate ever named.

A few days ago I directed some work to be done by measure; and I can now state it as the opinion of two very competent judges, that one machine will clear three miles in a day, twenty feet wide (consisting of four lengths, and making the day's work twelve miles) which is considerably more than 120 men can do in a day.

	l.	*s.*	*d.*
120 men, at 2*s.* per day	12	0	0
Four horses and two men can here be hired to work the machine for the day, at - -	1	5	0
Difference - -	10	15	0

At a distance, where carriages run principally in the centre of the road, the chief business in the management of it consists in keeping the sides clear and open. One machine may therefore be occasionally employed in outside work only; that is, may go six miles, and return, (making twelve miles, as just mentioned) with the saving already given.

Whatever surprise these calculations may occasion, the Society will perhaps be satisfied that I have not over-rated them, when I produce the result of a fair experiment, made on the 25th of February, in the presence of four trustees (Frederick Page, Esq. Francis Page, Esq. Mr. Thomas Clark, and Mr. John Baily) and others, by which it appears, that two miles, by measure, on the road to Reading, were cleared from mud, to the extent of 18 or 20 feet wide, by two machines, in the space of two hours and a half, by the watch; and the work was judged to be equal to the labour of more than eighty men in a day.

The success of this experiment was so satisfactory to the above-named trustees, for I was not present on the occasion, that they directed, without my knowledge, the remainder of our district on this road, extending seven miles, to be cleared in the same manner; and I can now declare, with some degree of pleasure, that this was actually completed by two machines in one day, viz. on the following day, the 26th of February. Of this day's work I have heard it affirmed, by an experienced surveyor, that it could not have been done in one day by 400 men.

I confess that I am myself unable, from the want of practical knowledge on this subject, to form a comparative estimate between the work done by this machine and by hand: I have therefore sought for information from persons of respectable characters, who have been surveyors, or renters of roads for many years; and I have been assured, as well by those who were present at the experiments, as by others who examined the roads afterwards, that it would require sixty men a mile, to do the work in one day, which a single machine will accomplish at four lengths; and it has been already shown, that three miles can, without difficulty, be cleared in a day: one machine will therefore do the work of one hundred and eighty men. But I have taken the average at only two thirds of this estimate, viz. at forty men per mile instead of sixty, being more willing that the power of the machine should at present be under-rated, than that the public should be deceived or disappointed concerning it.

The trustees of the London and Bath roads, being desirous of having these two machines, which had been constructed on my account, and under my own inspection, for making the experiments, I have consented to dispose of them: and as far as I am now able to judge, the price of a machine complete will be about ten guineas.

Finally, I must beg leave to advise those who are inclined to make a trial of this machine, to be careful whom they intend to employ in the construction of it; for I can assure them, that it is not sufficient to attend only to the form of the model; but it is absolutely necessary that the different parts, and especially the two braces behind, should be firmly put together, otherwise it will be impossible for it to withstand the force that must sometimes be exerted upon it by four, or perhaps by six horses. The scraper may be made of beech or elm, &c. but the other parts ought to be made of ash; and I must particularly recommend these materials to be well seasoned; all which circumstances were minutely attended to in the two machines which were made for me by Mr. Joseph Moss, of Greenham, near Newbury.

JOHN WINTERBOTTOM.

Certificates from Mr. George Goddard, Greenham, near Newbury, Mr. Francis Page, Mr. Frederick Page, Mr. John Baily, and Mr. Thomas Clark, accompanied the above paper; stating, that on the 25th of February last, two miles had been cleared in two hours and a half, by two of Dr. Winterbottom's machines.

REFERENCE *to the Engraving of Dr.* WINTERBOTTOM'*s Machine for clearing Roads from Mud.*—Plate VI.

Fig. 1, A A. Two pieces of ash timber, forming at one extremity a pair of shafts, B B.

C D E. Three transverse braces, to secure firmly the timbers above mentioned.

F. The iron plate, or front of the scraper, fixed within the braces C D, at an angle of thirty degrees, extending on the further side two feet, and on the nearer side one foot and a half beyond the timbers.

G. An iron chain, one end of which is fastened to the outside of the timber A; the other end of the chain may be moved nearer to, or further from that end of the scraper which deposits the mud, by means of notches in the iron muzzle H, fixed to the scraper, and which regulates the draught of the horses attached to the ring at G.

K. The pole, or handle, to be made fifteen feet long, which passes through the strong holdfasts in the braces C D. This pole acts as a lever, as the scraper may be raised or sunk by it, at pleasure. The person who holds it may direct the scraper in its proper line, and assist it in overcoming any obstacles it may meet with in its way, or in giving it additional pressure where necessary.

I I. Show the two parts of the machine which form the feet, or sledge part of the machine, on which it slides when reversed, and which enable it to be removed from place to place, when the scraper is not in use. These feet are strongly fixed to the timbers A A, and strengthened by a transverse brace betwixt them.

L. Is the iron chain, or back band, which lies upon the cart-saddle of the horse in the shafts, and which supports the shafts.

Fig. 2. Shows, on an enlarged scale, the iron-work, fixed on the outside of the shafts, to which the chain and horse are attached.

Fig. 3. Describes, in a small extent, the track usually made by the scraper in a large way, in four rows, commencing at the Arrow mark, in the track No. 1, returning after it has gone any length required by the track No. 2, proceeding again by the track No. 3, and forcing the mud collected by the tracks No. 1 and 3 to the right side of the road, and, on its return by the track No. 4, depositing the mud of the tracks No. 2 and 4 on the left of the road, as is more fully described in the preceding account, and thus clearing from mud a breadth of road twenty feet wide, by four passages of the machine.

The Sum of Fifteen Guineas was this Session voted to Mr. Thomas Fothringham, of Alloa, near Stirling, in Scotland, for manufacturing from the Abbey Craig Quarry, in that neighbourhood, Mill-Stones for grinding Wheat and other Grain.

The following Account and Certificates were received from him.

SIR,

HEARING that the Society for the Encouragement of Arts, &c. who have already given a premium to the person who first made Mill-Stones from the Scotch whin, also propose to give one to the person who has built the greatest number; I take the liberty of writing to you on the subject, as with respect to quantity I have far exceeded any in this country, having, for myself, built and disposed of twenty-eight and a half pairs in the course of the last twelve months.—Your taking the trouble to communicate to me such information as you may judge necessary, will confer a singular obligation on,

SIR,

Your most obedient Servant,

THOMAS FOTHRINGHAM,
Mill-stone Builder.

Alloa,
Nov. 29, 1802.

CHARLES TAYLOR, Esq.

SIR,

I WAS honoured with your favour of the 17th instant; and, in compliance with the directions therein contained, have collected Certificates from the different gentlemen and companies who employed me in making mill-stones for them or their friends. I flatter myself the evidence for twenty-five and a half pairs at least being built by me, will be found fairly established. If the Society find me entitled to a bounty, I shall receive it with gratitude.

I have the honour to be,
Sir,
Your most obedient Servant,
Thomas Fothringham.

Alloa,
Feb. 28, 1803.

Charles Taylor, Esq.

THE following Certificates accompanied the above letter; viz. from Messrs. Haig and Jameson, of Talliallan, stating that they bought of Mr. Thomas Fothringham two pair of millstones, four feet four inches in diameter, for which they paid thirty pounds ten shillings, and that they find them to be equal, if not superior, to French burrs.

From Messrs. John Bald and Co. of Carsebridge, stating that they had bought of Mr. Fothringham a pair of mill-stones four feet two inches in diameter, for which they paid fourteen pounds ten shillings.

From Mr. John Philps, of Dolls, stating that Mr. Fothringham had made for him and others, by his order, eight pair of mill-stones, all of which were above four feet in diameter, and for which he paid one hundred and thirty-two pounds.

From Mr. James Brownhill, of Alloa Mills, stating that Mr. Fothringham had furnished Meſsrs. Couan and Buel, of Parley, with a pair of mill-stones four feet six inches in diameter, for which they paid eighteen pounds ten shillings.

From Messrs. Henderson and Co. of Alloa, stating that Mr. Fothringham had built for them three pair of mill-stones, one pair of which was four feet two inches in diameter, and another three feet eight inches, and for which they paid forty-one pounds.

From Mr. Jameson, of Alloa, stating that James Haig, Esq. of Edinburgh, had purchased a pair of mill-stones of Mr. Fothringham, four feet and a half in diameter, by fifteen inches thick, for which he paid fifteen pounds sterling.

From Mr. John Stein, of Kennet Pans, stating that he bought of Mr. Fothringham nine pair of mill-stones, all which were four feet and upwards in diameter, and for which he paid one hundred and thirty-eight pounds eight shillings.

A Bounty of TEN GUINEAS was this Session voted to Mr. WILLIAM BOWLER, of Finsbury-street, for his Method of preventing Accidents to Horses and Carriages, in going down Hills, by a Gripe or Clasp acting on the Naves of the wheels of the Carriage.

The following Communication was furnished by him. A Plate and Description are added, and a complete Model is reserved in the Society's Repository.

SIR,

THE invention I have now sent you is, I think, likely to be of great use, and I therefore offer a model thereof for your inspection. In the first case, this cart may be stopped in an instant, in going down the steepest hill with a load, without stopping the horses, by the carter only pressing his hand upon a lever. This plan would likewise be highly advantageous in case of a horse taking fright, as the carriage may be instantly stopped by the brace clasping the wheels. It may also, with little alteration, answer for a broad-wheel waggon with a heavy load. By the present method, a coachman, whilst sitting on his box, may confine or release the wheels of his carriage at pleasure, and prevent accidents in descending hills, or in managing restive horses.

I am, SIR,

Your humble Servant,

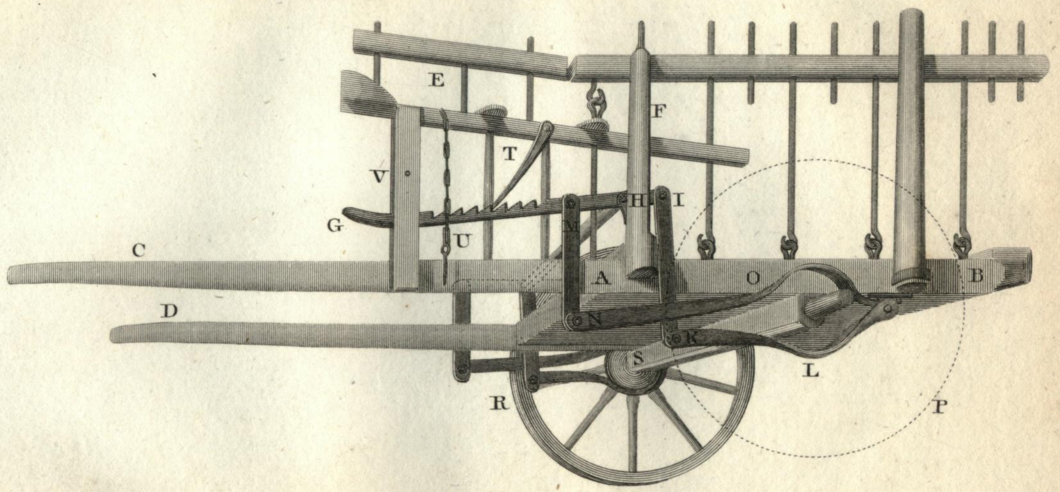
WILLIAM BOWLER.

Finsbury-street,
May 13, 1803.

To Mr. CHARLES TAYLOR.

RE-

Mr. Willm. Bowler's double Brace for Carriages.



Clint delt.

S. Porter sculp.

REFERENCE *to the* ENGRAVING *of Mr.* WILLIAM BOWLER'S GRIPE *for the Wheels of Carts and Carriages,* Plate VII.

A B.	The extent of the body of the cart.
C D.	The two shafts.
E.	The front ladder of the cart, part of which projects over the shafts, and is supported on them: the other part is fastened to the upright piece F.
G.	The handle of the lever, sliding betwixt two uprights, and moveable on an iron bar and pivot at H, in the upright piece F. By pressing down this handle, the moveable joints I K raise upwards the lower part of another lever L, so as to press against the lower part of the

nave of the wheel, and at the same time the moveable joints press down the lever O, and cause this lever to act against the upper part of the nave of the wheel; thus compressing the nave of the wheel betwixt a double brace, and either retarding wholly the motion of the wheel, or allowing it to move a little, as may be thought requisite. The circle of the nearer wheel is shown by the dotted lines P; but this wheel is not added, as it would prevent this gripe from being clearly seen. The handle of the lever G produces at the same time a similar effect on the further wheel R, by means of the bar of iron which crosses the cart at H, and acts in the same manner on similar double joints at the other side of the cart, as may be seen at S, where the further double gripe is shown pressing on the nave of the further wheel.

T. A small catch, which, by falling into the notches or teeth of the lever, when it is pressed down, holds both the gripes in one certain position.

When the wheels are to be set at liberty, the catch T is removed out of the teeth of the lever; then the lever G is raised above the hole V, and kept from sliding down by an iron pin attached to the chain U, being put underneath the lever, through the hole V.

The iron-work is not any inconvenience in the loading or unloading of the cart, nor occupies any room within it; and, what is of material consequence in new inventions, it may be managed by the carter with much less time and trouble than the common hook and drag chain. It is also much more secure in its action, as it binds on both wheels at once, and gives a uniform steady draught for the horses, which prevents them from falling down.

A Bounty of TEN GUINEAS was this Session voted to Mr. WILLIAM BOWLER, of Finsbury-street, for a SCREW PRESS with an expanding power.

The following Communication was received from him. A Plate and Description are added, and a complete Model is reserved in the Society's Repository.

SIR,

THE screw and spring-press which I have the honour to present to the inspection and for the approbation of the Society for the Encouragement of Arts, &c. will, I trust, be found in a superior degree adapted to the purpose of pressing bodies in general, but more particularly cheeses, apples, linen, &c. because such things require a firm and an unrelaxing pressure :—and this is a peculiar advantage incident to this machine; for after it is set, or the spring screwed well up, it will be found, that as the *article* pressed shrinks from it, so the spring, owing to its peculiar expanding power, gradually follows the object of its pressure, and hence continues to maintain a uniform and equal action on the body on which it is placed. This, in cheese-making, will be found peculiarly advantageous ; for it is from this very cause of want of sufficient pressing, that cheeses are frequently so very bad. Were the curd entirely separated from the impure and contaminating mixture of the whey, which must be effected by the regular action of this machine, we should always have the cheese firm and wholesome ; and, I have not a doubt, the press will be found equally useful in all other cases, and answer every purpose, even beyond expectation, to which it is adapted.

I have the honour to be

Your obedient Servant,

WILLIAM BOWLER.

April 13, 1803.

CHARLES TAYLOR, Esq.

REFERENCE *to the* ENGRAVING *of* *Mr.* WILLIAM BOWLER'*s* SCREW PRESS. *Plate VIII. Fig.* 1.

A A. The two upright sides, or frames of the press.

B. The cross piece which connects them at the top, having a hole in its centre, for the screw.

C. A strong block of wood, into which the two sides of the press are firmly morticed.

D. The box, in which the article to be pressed is placed. This box has a number of holes in its bottom, through which the liquid matter when pressed out passes, and is discharged from the mouth of the spout E, a small hollow being left under the box, to allow its passage to the spout. A loose wooden cover, fits into the box D, and upon it is fastened a stout piece of timber F, and an iron plate G, for the point of the screw of the press to act upon.

H. The male screw of the press, working in a female screw, in the centre of the strong cross piece I, which cross piece slides up and down in grooves within the two sides of the frame, one of which grooves is shown in the plate, and about half the length of the side piece.

K. The upper part of the iron screw, on which the handle L, which moves it, is placed upon a square. The iron of the screw is only wormed about half its length.

M. A strong spiral spring, made of iron wire, or iron rod, placed in the centre of the cross pieces B and I; this spring presses downwards against the cross piece I, forcing it as low down as the side grooves will permit. The male screw H lies within the circle of this spiral; and, when the screw is turned, passes through the female screw below it, and acts upon the iron plate G, under which the matter to be pressed is placed, by continuing to turn the screw. As it meets with resistance at the point G, it gradually forces back the cross piece I, by means of the female screw within it, and compresses the spiral into a small space, between the two cross pieces, in which state it remains, till the article which is pressed in the box begins to give out a part of its contents. The spiral spring M, compressed as above mentioned, then begins to expand, and exerts a continued re-action upon the cross piece

Mr. Roſs's Expanding Ring.

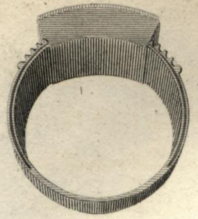


Fig. 4.

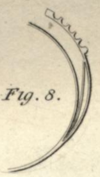


Fig. 8.

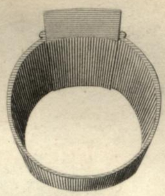


Fig. 3.

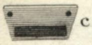


Fig. 6.

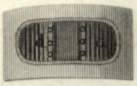


Fig. 7.

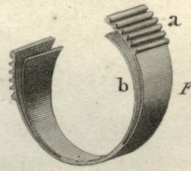


Fig. 5.

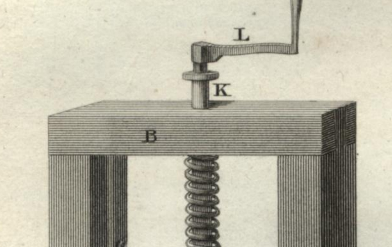


Fig. 1.

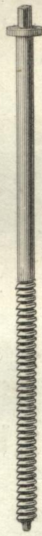


Fig. 2.

Mr. Wm. Bowler's Screw Preſs.

S. Porter sculp.

piece I, on the male screw H, the iron plate of which covers the article under pressure.

Fig. 2, Is the male screw, separated from the other parts, to show how far the thread or worm extends upon it.

A BOUNTY of TEN GUINEAS was this Session voted to Mr. I. D. Ross, No. 10, Bateman's Buildings, Soho-Square, for a RING with a contracting and expanding power, to fit various fingers.

The trade in Rings for home use and for exportation, is reckoned the next in extent and value in the jewellery line, to that of watch-making.

The following account was received from Mr. Ross. A plate and description are hereunto annexed, and a complete ring; also detached parts thereof, explanatory of its construction, are placed in the Society's Repository.

SIR,

IF an improvement in the execution of jewellery work falls within the views of the Society for the Encouragement of Arts, &c. I beg leave to submit to them a method I have invented for setting rings, which, by means of a spring gage, accommodates itself to a finger of any size.

However well a ring may fit at one season of the year, it frequently happens to be either too tight or too loose at another. In one case, the wearer is exposed to pain, and in the other to the hazard of losing perhaps a valuable ring. The trade will likewise be materially benefited, as they frequently lose the sale of valuable rings, for want of that nice adjustment which this contrivance affords.

The setting itself is ornamental, and as it is enlarged or contracted at pleasure, may in all cases be worn with ease and safety. The additional expense will not exceed four or five shillings.

I am, Sir,

Your obedient Servant,

I. D. Ross.

No. 36, Old Compton-street, Soho,
Nov. 23, 1802.

Charles Taylor, Esq.

This is to certify, that the undersigned persons have seen the spring gage ring, now before the Society for the Encouragement of Arts, &c. and approve of its principle, as being of utility to the trade in general.

B. Smart, working goldsmith, No. 55, Princes-street, Leicester-square; Parker and Birketts, goldsmiths, Princes-street, Leicester-square; Newman, ditto, No. 27, Piccadilly; Bilger and Son, ditto, No. 45, Piccadilly; Whitley, ditto, Old Bond-street; Davies, ditto, Bond-street; Bibby, ditto, Bond-street; T. Silberrad, ditto, Rose-street; W. Peartree, ditto, Bateman's Buildings; and Ellis and Collier, ditto, No. 52, Strand.

REFERENCE *to the Engraving of Mr.* ROSS'*s Contracting and Expanding Ring.*—Plate VIII, Fig. 3.4. 5.6. 7. 8.

Fig. 3. The ring in its contracted state.

Fig. 4. The ring in its expanded state.

Fig. 5. The lower part of the ring separated from its collet, to show the form of the springs: *a*, shows four small notches on the outer rim, which retain the ring at the size desired; *b*, the interior spring.

Fig. 6. A side view of the collet, where *c* shows the aperture into which the spring and notches of one side of the ring are introduced.

Fig. 7. A view of the top of the collet, with the stone taken out, where *d d* show the small pins, which prevent the springs of the ring from drawing out when extended to their greatest diameter.

Fig. 8. A profile of half the ring, in order to point out more clearly the form of the notches.

The SILVER MEDAL and TWENTY GUINEAS were this Session voted as a Bounty to Mr. JAMES WOART, of Fulham, for his method of raising a Roof sunk in the middle.

A reference to the XXth Volume of the Society's Transactions, p. 255, will show Mr. Woart's invention, by screws and levers, to secure from danger the *ends* of timbers and girders, injured by the dry rot or by time.

The great advantages of that plan are there fully pointed out. The application of screws and levers, to remedy roofs defective in their original construction, and sunk in their *centres*, is here detailed and explained.

The following letter was received from Mr. Woart. An engraving of the model accompanies the description, and the model is placed in the Society's Repository.

SIR,

HAVING, at your recommendation, been consulted upon the mode of applying that invention which obtained a premium from the Society for the Encouragement of Arts, &c. to a depressed part of the roof of Clapham church, I think it my duty to acquaint you, that I made the experiment with the most complete success.

The Society, who honoured my former model with such liberal notice, have a right to be informed to how great an extent the principle then submitted to their attention, may be carried. I have therefore to request, that the model upon which the machinery was constructed, for raising the roof of *Clapham

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* At Clapham church the girder was above fifty-eight feet in length, clear of the walls, and upwards of forty feet from the ground. It had sunk eight inches in its centre, and, on the plan here noticed, was raised to its original bearing, without any supporters being placed underneath it.

ham church, may be presented for their inspection; and am,

Sir,
Your most humble Servant,
James Woart.

Fulham, Oct. 27, 1803.

To Mr. Charles Taylor.

Letters from the Rev. John Owen, of Fulham, Mr. George Smith, of Putney, and Hennege Legge, Esq. of Putney-House, noticed, in high terms, Mr. Woart's character and abilities. Mr. Smith stated, in his letter of the 12th of May, the particular circumstances which occurred during the present business. H. Legge, Esq. at whose house the improvement made by Mr. Woart, as noticed in the former Volume, was executed, certified, on the 11th of May, 1803, that Mr. Woart was entitled from him to a testimony of his superior skill, and that he was also the efficient person employed on the present occasion.

REFERENCE *to the Engraving of Mr.* WOART'*s Method of raising a Roof sunk in its Centre.*—Plate IX. Fig. 1. *shows the new and old Truss combined.*

A A, Is the principal new truss. It is bolted into the old girder B B at C C, and also secured behind the said bolts, by firm corkings D D, four inches square, which may be made of hard wood or iron, and are let one half into the new principal A, and the other half into the old girder B, in order to prevent a lateral pressure upon the walls. The bolts go through the new truss A, and the old girder B.

E E E E, Is a new square oak frame; F F the slider within it; which slider is rather thicker than the square frame, and notched into the old king post at G, through which part it is bolted, with two iron bolts.

H H H H, Are four braces, framed at one end into the principal, and at the other into the square frame E. There are butments at the ends of each, and they are secured by iron plates: they are further strengthened by two cross pieces.

I I. Two bolts, with screws, extending from the top of the square frame E, through the slider F; which screws serve to raise up the king post, and the centre work of the old truss and roof, by means of nuts, under the sliding piece F.

K K K, Are three screws, hooked at the bottom, under the old girder B, which screws should be worked at the same time the slider is screwed up, in order to raise the sunk centre of the old girder to its proper height.

Pl. IX.

Mr Woart's method of raising a Roof sunk in its Centre.

Fig. 1.

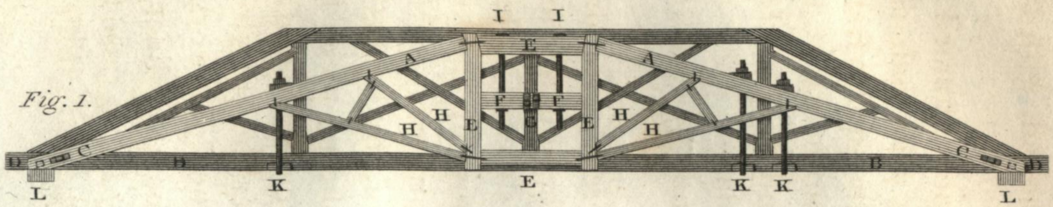
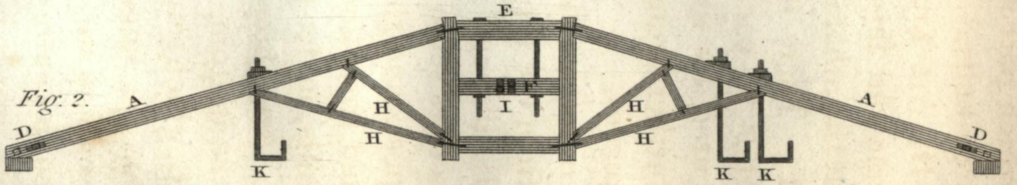


Fig. 2.



Clint delt.

S. Porter sculp.

L L. The wall plates, on which the girder lies.

Fig. 2. The new truss, shown separate.

A A. The principals; B, the square frame.

D D. The corkings, shown by dotted lines, being on the other side of the principals; they should be made of iron, or very hard wood.

E. The square frame, made of oak.

F. The oaken sliding piece, which is moveable in a groove, in the sides of the frame.

H H H H. The four braces, showing their butments.

I. The nuts and screws of the two bolts in the sliding piece.

K K K. The other screws; the hooked parts of which are exhibited in a side view, to explain their construction, and how they act upon the girder.

A BOUNTY of TEN GUINEAS was this Session voted to Mr. JOHN ANTIS, of Fulneck, near Leeds, for an invention to ascertain the number of Lifts made from a Mine, in any given time.

A Plate and Description are added, and a complete Model is reserved in the Society's Repository.

SIR,

I HAVE lately been encouraged by some gentlemen engaged in some coal mines in this neighbourhood, to invent a machine, which would infallibly tell the number of boxes of coals drawn out of a pit in the course of a week, or any given time. I have just now completed a model, which I think would answer the purpose extremely well.

Before, however, I make it known, I thought I would inquire of you, whether such an invention might be of a more extensive use, and as such would deserve the attention of the Society.

The machine is very simple, and need not be expensive; its properties are as follow:

1. It is of no consequence if the pit be ten, twenty, forty, or more yards deep. It will, notwithstanding this difference, only point out one box at once; and, supposing the pit to be several hundred yards deep, the principle will remain the same, and the machine could be easily adapted for it.

2. It is likewise of no consequence if the coals be drawn up by a hand windlass, or any other machine turned by horses or other powers.

3. No account is necessary to be kept for a whole week, or any given time, as the machine can be calculated for any quantity of coals whatever, that can be drawn up in a given time. Only allowance must be made for the

number of persons that go down and up in the same way.

I have not yet heard of any contrivance of this kind; and therefore, if there be any such, it is unknown to me. Whoever knows the fraud, which is but too often committed by banksmen, in accounting for the quantity of coals procured from a pit, will readily admit the utility of such a contrivance. And it may most likely also be useful in tin, lead, and other mines. Should the Society be of the same opinion, then I will send you a still more complete model than at present. Your speedy answer will very much oblige

Your most obedient Servant,

JOHN ANTIS.

Fulneck,
March 6, 1802.

CHARLES TAYLOR, Esq.

SIR,

I HEREWITH send you a model of my machine, which I have before mentioned to you, for pointing out any number of boxes or baskets of coals, or other minerals, which are drawn out of a pit in any given time. I shall be much obliged to you, if you will lay it before the Society for the Encouragement of Arts, &c. for their inspection, and shall be glad that they find it of public utility.

It will easily be perceived, that by enlarging the wheels and multiplying the cogs of them, the number of yards required for the depth of a mine, as likewise the number of boxes which are wanted to be pointed out may be carried to any extent.

I am so little acquainted with coal-pits, or any other mines, that I do not know the technical terms by which the different parts are called, nor all the methods now used to draw up those materials; I must therefore beg the indulgence of the Society, if I do not always express myself with accuracy.

By inventing this machine, I aimed at ascertaining the number of boxes, my ideas respecting which I will endeavour to describe, to the best of my abilities.

First, the rope must be so long, that it can be fastened at its middle to the windlass, and that each end thereof may reach to the bottom of the pit. This precaution will not be necessary, if it can be prevented by any other means from shifting or sliding, which I leave to others, more acquainted than I am with the present practice, to effect.

The roller A, *Plate* X, *Fig.* 1, in the model, with the endless screw, represents the gudgeon in full size of a hand windlass, such as are used in this neigh-

Mr. Antis's Indicator of the Number of Draughts from a Mine.

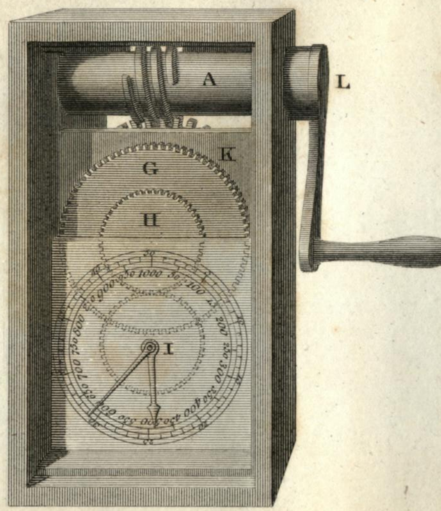


Fig. 2.

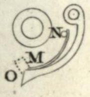


Fig. 3.

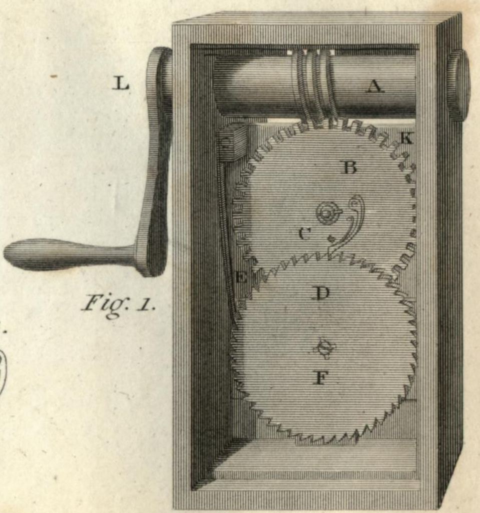


Fig. 1.

S. Porter sculp.

neighbourhood, particularly where the pits are of considerable depth. As no great stress is laid upon this screw, it may be made, in order to save labour, of brass, and driven, or otherwise fastened, upon any gudgeon. I suppose the windlass to be one yard in circumference; and consequently forty revolutions of the windlass are required before the first wheel B, upon which the brass catch C is fixed, turns once round. The pit, therefore, may be only ten yards, or from seventy to seventy-five yards deep, yet it will make no difference. All that is required to regulate the machine to the depth of the pit, is as follows :—If the pit be little more or less than ten yards, the first wheel must be so placed in the endless screw, that the brass catch C may be at the beginning, but just escaped from the cogs of the second wheel D. It will then only want five or six revolutions of the windlass

lass backwards, before the said catch is ready to operate again. But supposing the pit to be seventy yards deep, in this case, the catch C must be placed so as nearly to be ready to act. By turning backwards, the wheel may very nearly make two revolutions; and as it can be still turned as far the other way, the catch will only act once, provided the said wheel does not quite make two revolutions.

The model is about the size required for a common hand windlass. The index will at once show how many times fifty boxes, and how many above and below that number, have been drawn up: not one of them can escape. Allowance, however, must be made for the number of persons who go up and down in the same way. Besides this, since one box is always coming up, whilst the other is going down, the numbers pointed at must be doubled, except a person was desirous to have a machine acting both ways, which would hardly be worth while. As the machine is at present, though it points out a thousand boxes only, yet it will serve for two thousand.

The same mechanism, with very little variation, may be fixed to a horse machine, called a gin, in this neighbourhood; viz. as a gin may be ten yards or more in circumference, the action would be too slow, if moved by an endless screw; a pinion, with four leaves, will be found much more convenient. This pinion is fixed to the end of the upper gudgeon, which enters the box containing the machinery. As some accuracy is required to make such a pinion work well, and these machines are often coarsely constructed, it will be necessary only to make about one inch and a half of the end of the said gudgeon exactly round, namely, that part of it which goes through the bottom of the box, and then fasten the latter so, that it can give way to any remaining inaccuracy of the other parts of the gudgeon.

I have sent a drawing* of such a machine, which will be easily understood, since the principle is the same as in the model. But as gins are commonly made use of in deep mines, I have made it upon a larger scale; viz. the first wheel has sixty-four cogs; and this, with a pinion of four leaves, will require sixteen revolutions of the gin, for one of the wheel. Allowing ten yards for the circumference of the gin, it will make one hundred and sixty yards of rope; and considering that the said wheel can nearly make two revolutions, and that the catch will still act only once, it will consequently serve for a pit of three hundred yards deep, as well as for one of ten or twenty.

In this machine, the three wheels are placed one on another, and the index is divided; viz. the fifty on the second, and the 1000 on the third wheel. As the wheels move, the two hands are standing, which will point out the numbers as exactly as those in the model. Indeed, machines for hand windlasses may be made in the very same way, and thereby be more simple, though the difference is but small; viz. the box would require but one lid and lock, and the two smaller wheels become unnecessary.

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* This drawing is in the Society's possession.

Though in setting the machine so as to begin counting with one, it may easily be effected by lifting out the spring, and then turning the wheel with the other hand, till both hands stand upon one, yet, in the double index, the upper hand must only be set thus with the wheel, and the lower may be moved round on its socket.

In my humble opinion, my machines may be useful in two ways; first, to the honest banksman, as they will save him the trouble of noting down each box which is drawn up, and prevent mistakes; secondly, in the prevention of fraud, which will be their greatest and most important use. To obtain this end, it is necessary that the machine be so contrived, that nothing essentially wanted can be disengaged. I have therefore made the model so as to frustrate any such design. All is within the box; and neither the endless screw can be disengaged from the wheel, nor the spring; nor can the number on the index be altered without first opening the box. This latter can be made of iron, if found necessary, with a good lock to it; otherwise, the stress is so very little, that even one of wood, made in all respects like the model, would answer, if it could be secured from the effects of the weather. In the machine likewise, represented by the drawing, nothing can be altered, except the box be first opened. This machine is fastened to the beam in which the upper gudgeon turns. To effect this, the bottom of the box must have two projecting ends with holes in them, larger than necessary to receive a strong pin or rivet; which pins must have large heads, so that when properly driven or riveted in, the box may be able to give way to any remaining inaccuracy in the lower parts of the gudgeon, as I before observed. Those machines for hand windlasses, like the model, are fixed to the side of the post into which one of the gudgeons turns; but perhaps these might likewise be contrived so, that the gudgeon with the endless screw may be a piece by itself, attached only to the windlass by a square, or otherwise, as is often practised in other machineries, such as cotton-mills, &c.

I am, Sir,
Your obedient Servant,
John Antis.

Fulneck, May 18, 1802.
Charles Taylor, Esq.

REFERENCE *to the* MODEL *sent by Mr.* ANTIS *to the Society.*

Plate X. Fig. 1. A. The roller, with an endless screw, to be the size of the gudgeon of a hand windlass.

B. The first wheel, of forty teeth, with a brass catch C. It may be moved backwards or forwards by the endless screw.

D. A ratchet wheel with fifty teeth, which, when the wheel B is put in motion one way, the catch will slide over the teeth of it; but, on turning it the other way, the catch will drop into and forward this wheel one tooth, in which situation it is prevented from returning by the spring E, placed on the side of the box which holds a tooth on the side of the wheel.

F. A small pinion of four teeth, on the back part of the axle of the wheel

D. This pinion moves a large wheel on the other side of the box.

Fig. 2. G. The large wheel last mentioned: it has eighty teeth.

H. A smaller wheel of fifty teeth, fixed fast on the face of the wheel G; which wheel H works a wheel I, of the same number of teeth, shown by dotted lines behind the figured dial-plate.

K. The short hand, or finger of the dial, is placed upon an arbor or collar of this wheel I, and moves with it.

The long finger, or hand of the dial-plate, goes upon a square on the end of the spindle on which the above arbor moves; which spindle moves forward this long finger one division in fifty of the outer circle marked on the dial-plate, every time the rope, or any thing attached to it, has been down to the bottom of the mine, and returned to the top.

The inner circle of the face of the dial is marked in divisions of fifty each.

When therefore fifty draughts up and down have been made from the mine, the shorter hand will be found, if both hands were originally set correctly at the top, to have moved to the first interior division marked 50; and so on, in proportion, will advance as more draughts are made.

K, Is a board placed under the wheels BD, in *Fig.* 1, and which separates them from the other wheel-work in *Fig.* 2, where only a few teeth of the wheel B appear behind it.

L L, Show the temporary handles in both figures; and the position of those letters denote that the gudgeon of the windlass, when the machine is in actual use, should be there joined to, or make a part of the roller A.

Fig. 3, Shows, on an enlarged scale, the form of the catch C. The steel spring M pressing against the pin N, returns the catch to the tooth of the wheel D, when it has been forced back;

and a pin fixed underneath the catch moves in a groove O, made in the wheel B, to prevent the catch being pressed too far back, or thrown out improperly by the spring.

A door is fixed on each side the box, and should be locked, to prevent the hands being altered unknowingly.

The drawing of a machine for similar purposes, intended to be used with a gin or horse wheel, alluded to in Mr. Antis's letter, is in the Society's possession, if a reference thereto be thought necessary.

A Bounty of THIRTY GUINEAS was this Session voted to Mr. JOHN PRIOR, of Nessfield, in Yorkshire, for his Striking Part of an Eight-Day Clock.

The following Account was received from him. An Engraving of this Machine accompanies the Description; and a Model is placed in the Society's Repository.

SIR,

I HAVE taken the liberty of sending to you a new striking part for an eight-day clock, of my own invention and workmanship, which I finished last April; but, as that time was so near the recess of the Society, I thought it would be better to keep it in my possession till November. I hope therefore you will have the goodness to lay it before the Society for the Encouragement of Arts, &c. the first opportunity.

I beg leave to inform the Society of some of the advantages arising from this new invention.

First, its principle consists in a wheel and fly, with six turns of a spiral line, cut upon the wheel, for the purpose of counting the hours. The pins below this spiral elevate the hammer, and those above are for the use of the detent.

This single wheel serves the purpose of count wheel, pin wheel, detent wheel, and the fly wheel, and has six revolutions in striking the twelve hours.

Permit me to suppose a train of wheels and pinions, used in other striking parts, to be made without error, and that the wheels and pinions would turn each other without shake or play. Allowing the above supposition to be true, which every mechanick knows it is not, my striking part will be found six times superior to others, in striking the hours 1, 2, 5, 7, 10, 11, and twelve times, in striking 4, 6, 8, and eighteen times, in striking 3, 9, and 12.

I have designedly made a defect in the model herewith sent, in striking 2 and 3 o'clock, to show that what I have now advanced will, upon the trial, be found to be true.

In striking 2, I have purposely made an imperfection, equal to the space of three teeth of the wheel; and, in striking 3, an imperfection of nine or ten teeth; and yet both these hours are struck perfectly correct.

The flys in clocks turn round, at a mean, about sixty times for every knock of the hammer, but mine turns round only three times for the same purpose; and suppose the pivots were of equal diameters, the influence of oil on them would be as the number of revolutions in each.*

It would be better for clocks if they gave no warning at all, but the snail-piece to raise a weight somewhat similar to the model now sent for the inspection of your respectable Society.

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* See Cummings's Elements.

REFE-

REFERENCE *to Mr.* PRIOR'S *Striking Part of his Clock.*—Pl. XI. Fig. 1.

A. The large wheel, on the face of which are sunk or cut the six turns of a spiral.

B. The single worm screw, which acts on the above wheel, and moves the fly C.

D. The spiral work of the wheel A. The black spots show the grooves into which the detents drop, on striking the hour.

E. The groove into which the locking piece F drops, when it strikes one, and from which place it proceeds to the outward parts of the spiral in the progressive hours, being thrown out by a lifting piece H, at each hour; the upper detent G being pumped off with the locking piece F, from the pins in the wheel A.

Mr. Prior's striking part of a Clock.

Pl. XI.

Fig. 2.

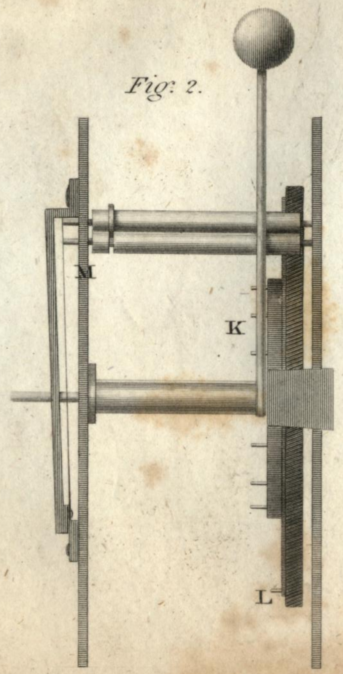
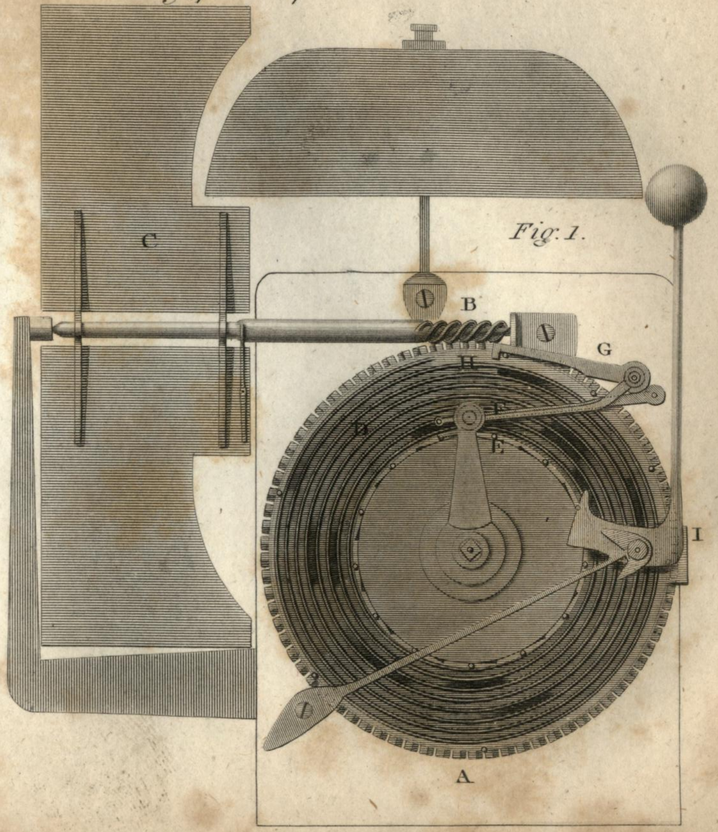


Fig. 1.



Clint delt.

S. Porter sculp.

In striking the hour of *twelve*, the locking piece, having arrived at the outer spiral at H, rises up an inclined plane, and drops by its own weight to the inner circle, in which the hour *one* is to be struck, and proceeds on in a progressive motion through the different hours till it comes again to *twelve.*

I. The hammer-work made in the common way, which is worked by thirteen pins, on the face of the spiral.

Fig. 2.—K. The thirteen pins on the face of the spiral, which work the hammer-work.

L. The outer pins, which lock the detent.

M. The pump spring to the detent.

A Bounty of TWENTY GUINEAS was this Session voted to Mr. EDWARD MASSEY, of Hanley, in Staffordshire, for his Striking Part of an Eight-Day Clock; from whom the following communication was received. A Plate and Description are added; and a complete Model is reserved in the Society's Repository.

SIR,

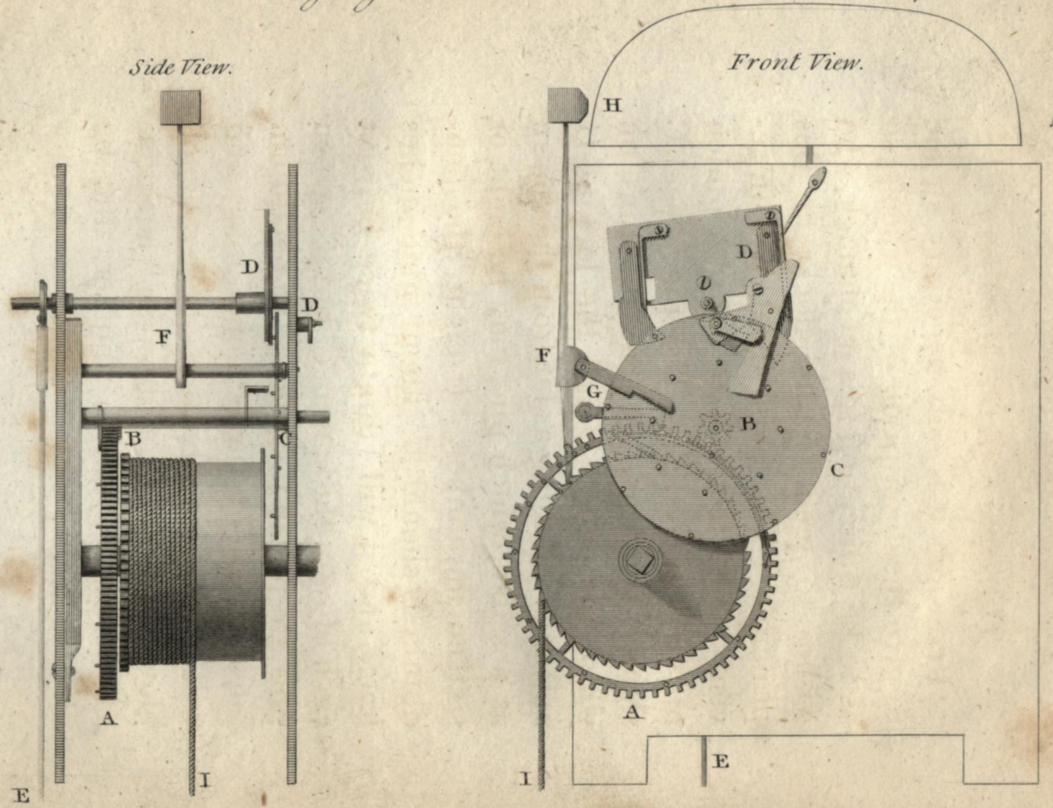
HAVING for a number of years considered a method of striking a clock, at certain regular intervals, which I conceive may be of great service in making observations on the heavens, and ascertaining the velocity of sound, &c. I beg leave to lay before the Society for the Encouragement of Arts, &c. a striking part of an eight-day clock, which I have no doubt will answer the purpose intended; and if, upon examination, the Society should be of opinion that it may be useful, I trust they will reward it according to its merit. They will find that the work of this model is less than that of the common striking movements, and may be made by a common workman, with less expense and trouble; the weight required is also considerably less. The principle I act upon is the pendulum, by which I regulate the stroke, instead of the fly; the advantage of which must be obvious to every one. The machine consists of a toothed wheel A, one pinion B; a pin wheel C, pallets D D, pendulum E, and locking detent G. The hammer-work F is as usual, and strikes on the bell at H. The weight hangs to the cord I. See *Plate XII. Fig.* 1 and 2, where a front and side view of the machinery are given, and where similar letters denote the same parts in each view.

Description of the Machinery.

I consider it is only necessary for me to give the description of the wheels, so as to be a direction to a mechanick, who wishes to manufacture clocks on this principle. The main wheel A, with seventy-eight teeth, is to act in a pinion of eight leaves, B. The pin wheel C should be large, so that the pins on which the pallets D and the locking G act, may be flung as far from the centre as possible, which pins may be eight or sixteen in number. If eight, the pendulum E should be about nine inches long, and it will vibrate twice betwixt each blow of the hammer; but if sixteen pins are put in the wheel, the pendulum must be about three inches long, and will make four vibrations betwixt each blow. The pins for drawing the hammer must be eight in number, and be fixed in a circle of about half the diameter of the aforesaid pins. The locking

Mr Maſseys Clock to strike without a Fly.

Pl. XII.



Side View.

Front View.

Clint del.

S. Porter sculp.

ing plate is on the main wheel. The stop is against the pins on which the pallets act, and may be discharged by a flirt piece.

As I have described the model, I beg leave to point out the method of striking a clock by the common pendulum, true seconds, without any additional pendulum or pallets for the striking part.

Description.

Fix a cantrite wheel with sixty teeth on the same arbor with a swing wheel of thirty teeth. Now suppose a striking part to be made in the common way of making an eight-day clock, so far as the pallet pinion, leaving out the warning and fly pinions. A crank piece must be fixed on the pallet pinion, which must come into contact with the cantrite wheel, which is fixed on the swing wheel arbor. Then suppose the clock to be set a going, and the rack discharged, the pallet pinion will make a revolution on every vibration of the pendulum, by which means a clock will strike seconds as true as a pendulum vibrates, which I hope will be considered as useful for the purposes I have described. I also beg leave to observe, that a great advantage arises in both the above machines, from their not being liable to foul, as the stroke is given by the certain and regular vibration, instead of the uncertain motion of the fly. Its advantage likewise depends on the cleanness of the work; and church clocks will be much benefited from the decrease of weight.

I am, Sir,
Your most obedient Servant,
Edward Massey.

Charles Taylor, Esq.

Hanley, in Staffordshire,
Jan. 12, 1803.

A Bounty of FIFTY POUNDS was this Session voted to Mr. EDWARD MASSEY, of Hanley, in Staffordshire, for his Improvements in the diminishing the Friction in Escapements of Pendulum Clocks.

The following account was received from him; and Engravings of these inventions, with descriptions, are hereunto annexed, and Models of them are placed in the Society's Repository.

SIR,

HAVING for a considerable time considered a method of diminishing the friction in escapements of pendulum clocks, which I conceive may be of great service in making better timekeepers, by relieving the pendulum from obstructions occasioned by friction in the train of wheels, and on the acting part of the pallets, I beg leave to lay before the Society for the Encouragement of Arts, &c. two escapements, which I have no doubt will answer the purpose intended. The difficulties which I propose to diminish in clock escapements, by this invention, are as follow:—first, it is allowed, that when the pressure against the recoiling escapement is diminished, as it is liable to be, from increase of friction in the wheel-work, the vibrations of the pendulum will not be performed in so short an interval. This circumstance has the contrary effect on a dead beat; for when the pressure against the locking is the greatest, the vibrations will occupy a longer interval of time; so that the vibrations of the pendulum are liable to be affected from two causes—from an increase of friction on the acting part of the pallets, and from an increase or variation of friction in the train of wheels. These are the objects, which I have bestowed great pains and expense to remove.

I beg leave therefore to give a decription of two models of my improved escapement that accompany this letter. First, a swing wheel is made, in the usual way of making it for a dead beat, except that it is not necessary to make the teeth with fine points. The pallets, instead of being fixed on the verge in the usual way, are fixed on two light detents, one on each side of the swing wheel. The lockings are on the inclined planes of the pallets, which are pressed against the teeth of the swing wheel, by remontoiring springs, which should be under the command of the weight or main spring, so that if an increase of friction should take place in the wheel work, the vibrations of the pendulum will not be much affected, so long as there remains a power to raise the inclined planes. A momentum is communicated to the pendulum through these inclined planes, by two arms fixed on the verge, which come into contact with them, and unlock one on each vibration of the pendulum. Thus, suppose a momentum to have been given by the inclined plane on the right; at the same time that this takes place, the wheel moves forward, and raises the inclined plane on the left, and the pendulum, having performed its oscillation to the left, receives a momentum from the inclined plane, to compensate for the loss of power which would take place during the ensuing vibration to the right, and so on alternately. The advantage in this model consists, I conceive, in diminishing the friction in the acting part of the pallets, in giving a regular certain momentum, independent of any variation which may occur in the wheel work, or on the acting part of the pallets, except during the short time of unlocking.

The second description, being a free pendulum without a verge, is as follows:—The swing wheel must be on the outside of the back plate. The pallets are formed like a pair of tongs, and are a fixture to the clock. There is a spring fixed in the upper part of the tongs, which keeps them extended against the points of the adjusting screws. The points of the tongs are pallets, with inclined planes, and have lockings, as the one above described. The tongs are made to spring from the point by which the pendulum is suspended, and, by altering the adjusting screws, a proper tension may be given to the spring part of the pallets; but they must be sufficiently under the influence of the main power. I think the main power should be about one third more than is necessary to raise the inclined plane, so as to allow for an increase of friction, which may take place in the wheel work. There must be a cross piece fixed to the pendulum, which must come into contact with two pins that are fixed in the inclined planes of the pallets, so as to unlock one on each vibration of the pendulum. Suppose the pendulum to be put in motion, and to have unlocked the inclined plane on the right; the wheel moves forward, and raises the inclined plane on the left, at which time the pendulum receives a momentum from the spring pallet on the right, and, after performing its excursion to the left, receives a momentum, as on the right, and so on alternately. The advantage of this escapement over that above described is, that it avoids the friction of the verge and detent pivots, and during a part of the vibration the pendulum is disengaged, so that it is a free pendulum. Having no doubt that the Society will judge of this invention with their usual liberality and candour,

I remain, Sir,

Your most obedient Servant,

Edward Massey.

March 17, 1803.

Charles Taylor, Esq.

REFERENCE *to Mr.* MASSEY'S *methods of diminishing the Friction in Escapements of Pendulum Clocks.*

Plate XIII. Fig. 1.—FIRST METHOD.

A. The swing wheel.

B C. The two pallets.

D D. The detents on which the two pallets B and C are fixed.

E. One of the *remontoire* springs on the left side; another, similar to this, is on the right side of the frame, but is not shown in the plate.

F. The verge.

G. The arms fixed on the verge, which act on the pins H I of the pallets.

K. The pendulum, fixed in the usual way on the verge.

Fig. 2.—SECOND METHOD.

a. The free pendulum, without a verge.

b. The swing wheel, on the outside of the back plate.

c. d. The pallets, formed like a pair of tongs.

e. A spring, which keeps them extended against the points of the adjusting screws.

f. g. The points of the pallets.

h. i. The adjusting screws of the pallets.

k. The cross piece fixed to the pendulum, which piece, as the pendulum moves backwards and forwards, comes in contact with the two pins on the points of the pallets *f g*, and relieves the wheel.

The pendulum is supposed to be in motion, and the dotted lines show those parts of the machine which are hid by others.

Mr. Maſsey's Improvements in Pendulum Clocks.

Fig. 2.

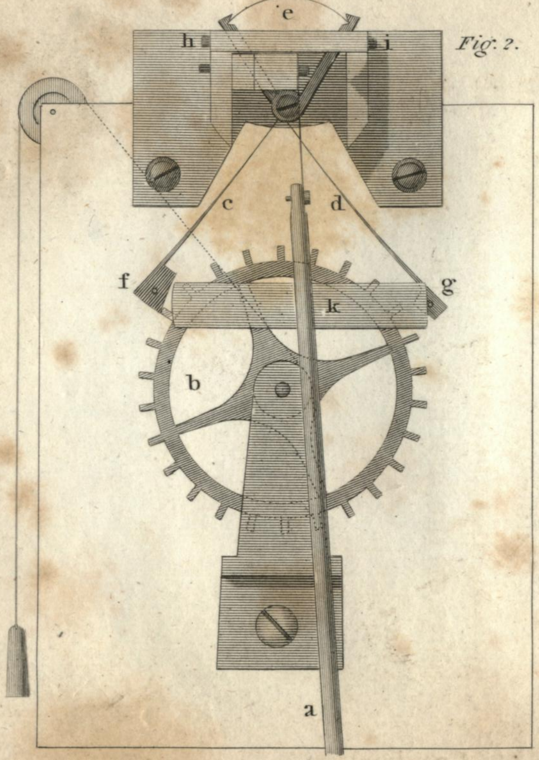
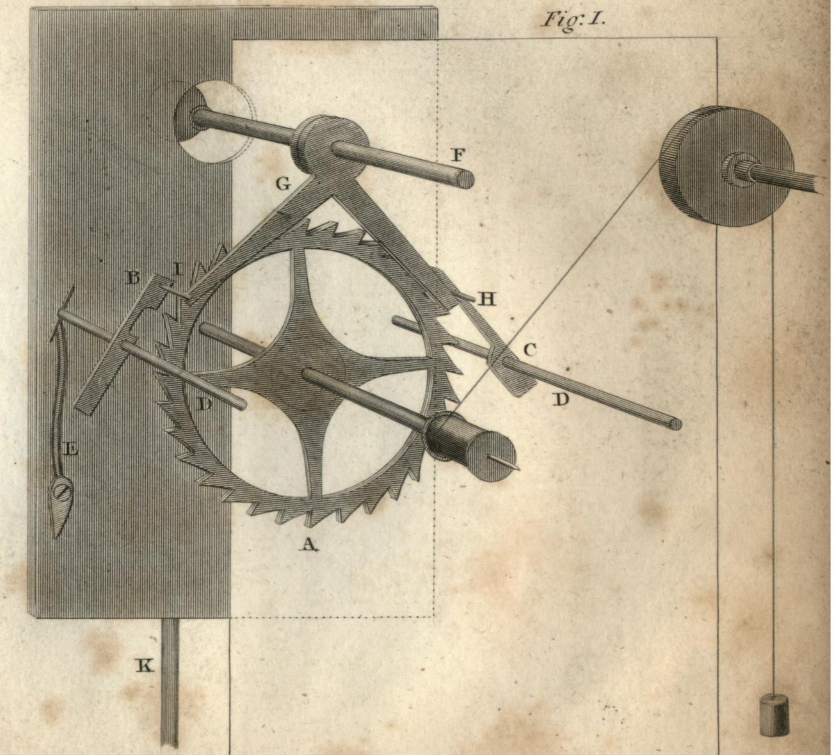


Fig. I.



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S. Porter sculp.